WHAT IS CLAIMED IS:

1. A process for continuously mixing and reacting at least two fluid streams, the process comprising:

   a) flowing a first fluid stream through a first feed channel and injecting the first fluid stream in a substantially radial direction into a mixing chamber;

   b) flowing a second fluid stream through a second feed channel and injecting the second fluid stream in a substantially tangential direction into the mixing chamber to create a vortex;

   c) reacting the first and second fluids within the mixing chamber at reaction conditions and in the presence of a catalyst to yield a product stream, and;

   d) withdrawing the product stream from the central portion of the mixing chamber.

2. A process for continuously mixing and reacting at least two fluid streams, the process comprising:

   a) flowing a first fluid stream through a first feed channel and injecting the first fluid stream in a substantially radial direction into a mixing chamber;

   b) flowing a second fluid stream through a second feed channel and injecting the second fluid stream in a substantially tangential direction into the mixing chamber to create a vortex;

   c) withdrawing a stream of mixed first and second fluids from the central portion of the vortex, and;

   d) reacting the stream of mixed fluids in a reaction zone at reaction conditions and in the presence of a catalyst to yield a product stream.

3. The process of claim 2 where the first fluid stream comprises a hydrogen feed stream and the second fluid stream comprises an oxygen feed stream, where

hydrogen is present in an amount of less than about 3% by volume relative to the amount of both hydrogen and oxygen.

4. The process of claim 2 where the ratio of the kinetic energy of the second fluid to that of the first fluid is at least about 0.5 to yield a fluid vortex within the mixing chamber.

5. The process of claim 2 where the mixing chamber is substantially cylindrical in shape.

6. The process of claim 2 where steps (a) and (b) comprise flowing a plurality fluid streams through a plurality of feed channels and injecting the fluid streams in alternating tangential and radial directions into the mixing chamber.

7. The process of claim 2 where step (a) comprises accelerating the first and second fluid streams through the feed channels in the direction of the mixing chamber.

8. The process of claim 2 where step (b) comprises, prior to injecting the second fluid stream into the mixing chamber:

   a) distributing the second fluid stream among a plurality of second distribution streams;

   b) distributing a third fluid stream among a plurality of third fluid distribution streams, with the second and third distribution streams in a repeating sequence in the second feed channel.

9. The process of claim 2 further comprising separating the product stream into a heavy fraction and a light fraction and recycling either the heavy fraction or the light fraction to the mixing chamber.

10. The process of claim 2 where the first fluid stream is a gas and the second fluid stream is a liquid.

11. The process of claim 2 further comprising, after step (c), passing the stream of mixed first and second fluids through a conduit to the reaction zone, where the conduit diameter is less than about 200μm.